

Note on the Formation of the Epiphragm of *Helix aspersa*.

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[Read 18th June, 1896.]

THE mode of formation of the epiphragm or temporary lid by which our common garden snail (*Helix aspersa*) closes the aperture of its shell on the approach of winter, and during the continuance of hot and dry weather, does not appear to have been as yet satisfactorily described.

The epiphragm of various species of *Helix* forms the subject of a memoir by Fischer*, who erroneously assigns its formation to a secretion from the foot. Binney† has made some interesting observations on its formation in *Helix hortensis*, and attributes it to the collar or adherent mantle-margin—a conclusion which, so far as it goes, is correct, but he takes no notice of any special modification by which this part of the animal may become fitted for the duties assigned to it. Vogt and Yung‡ refer to its formation in *Helix pomatia*; and while they also regard it as a secretion from the collar, they enter into no further anatomical or physiological details.

In *Helix aspersa* the epiphragm is formed by a secretion from the surface of a specially modified area of the mantle-margin. It will be borne in mind that in *Helix*, as in other terrestrial representatives of the testaceous pulmonary Gastropods, the proper mantle possesses no free mantle skirt, but is represented by the general integument of the body (*pl.*), terminating ventrally in an even rounded and slightly thickened and everted margin, which, like the rest of the mantle, except where it lies over the respiratory chamber, is adnate to the surface of the body. This rounded mantle-margin is the so-called collar. From its whole extent there is developed a thin glandular fold (*c.i.*) which is inflected over the ventral side of the snail, where it forms a centrally perforated muscular disc. On retraction of the animal within its shell, this can be extended centripetally, so that its inner edge may reach the centre, and thus completely close the aperture. It is from the

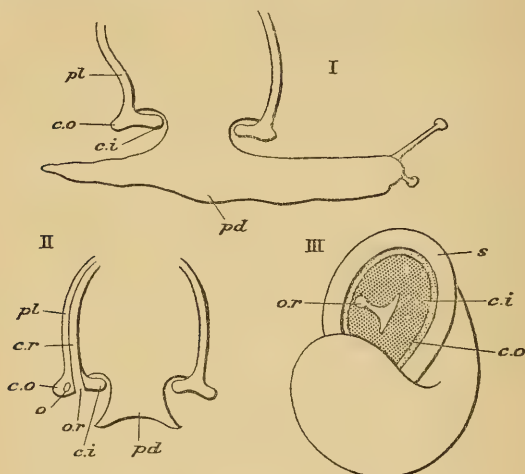
* Paul Fischer, "De l'Epiphragme et de sa formation," Journ. de Conchyliologie, 1853, vol. iv. p. 397.

† W. G. Binney, "The Terrestrial Air-breathing Molluscs of the United States," Bull. Mus. Comp. Zool. Harvard Coll., vol. iv. 1878.

‡ Carl Vogt et Émile Yung, 'Traité d'Anatomie Comparée pratique,' 1838, vol. i. p. 772.

outer surface of this inflected inner collar-lobe or *phragmatogenic disc* that the epiphragm is mainly formed, as a mucous secretion which soon hardens into a thin membrane of horny consistency, and which may increase in thickness by successive deposits from the disc.

By the contraction of the inflected disc an open space of greater or less extent will be left in its centre, and through this



Formation of the Epiphragm in *Helix aspersa*.

- I. Longitudinal dorso-ventral section through ventral region.
 II. Transverse dorso-ventral section through ventral region.
 III. Front view of aperture of shell, showing the inflected disc for the secretion of the epiphragm.

c.i. Mantle-rim. Inner collar-lobe or phragmatogenic disc. (In I. and II. with the central opening expanded for the protrusion of the ventral region of the snail. In III. with the central opening nearly closed.)

c.o. Mantle-rim ("collar") on the collar-lobe.

c.r. Respiratory chamber.

o. Osphradium?

o.r. Respiratory orifice. (In III. showing the fissure which connects the orifice with the central opening.)

pd. Foot.

pl. Mantle coincident with the general integument.

s. Margin of shell.

The figures are diagrammatic.

the foot and head of the snail may be protruded and again entirely withdrawn.

Close to the rim of the mantle, on the right side of the animal, the disc is perforated by the respiratory orifice (*o.r.*) leading directly into the respiratory chamber (*c.r.*). This orifice is connected with the central aperture of the disc by a fissure (fig. III.), which, like the central aperture, can be closed by the approximation of its edges.

When the epiphragm is about to be formed, the foot and head of the snail are much contracted and entirely withdrawn deep into the shell through the central opening in the disc, which is then completely closed, leaving an even continuous surface for the secretion of the epiphragm.

Immediately over the site of the respiratory orifice the epiphragm is perforated by a small aperture which affords access from without to the atmospheric air, which even during the period of repose may still be needed for respiration—a function which during the dormancy of the animal is probably not quite arrested*.

Access to the atmospheric air is also probably connected with the presence of an osphradium or olfactory organ, which may perhaps be recognized in a small patch of modified ectoderm (*o*, fig. II.) visible close to the edge of the respiratory orifice.

It may also be noted that the perforation of the epiphragm has an uneven edge, and gives the impression of having been caused by the action of some solvent on the substance of the epiphragm. When we bear in mind that it is in close proximity with the respiratory orifice, that exit is given to the renal secretion as well as to the contents of the alimentary canal after this has received the secretion of the digestive gland (so-called liver), we shall perhaps deem it not improbable that some of these secretions have acted as a solvent on the epiphragm, the orifice of which is situated exactly in the position best fitted to bring it within reach of their action.

When the conditions which call for the formation of an epiphragm are present, the snail seeks for some surface to which it may apply the aperture of its shell in such a way as to exclude the free access of the external air. This may be the shell of

* I have never met with *Helix aspersa* in a state of hibernation in which the perforation of the epiphragm was not present; and yet I can find no published account of it. In conversation, however, with Col. Godwin-Austen, whose researches among the terrestrial Gastropods have contributed so largely to our knowledge of these animals, I found that its existence was well known to him.

another snail; and we frequently find during the winter months large colonies of hibernating snails attached firmly to one another. After selecting a suitable locality the first act is to throw out from the mantle-margin, in which the secreting function would seem to be especially active, sufficient material to glue the edge of the shell firmly to the subjacent surface. When this has been accomplished, the epiphragm is completed by a secretion from the general surface of the phragmatogenic disc.

On the approach of spring, and when the conditions rendering necessary the presence of an epiphragm no longer exist, the snail once more awakens from its sleep, and the central opening in the phragmatogenic disc again makes its appearance, and gives exit to the foot and head of the snail, which then, pressing on the membranous epiphragm, ruptures it, and thus allows the animal to enter freely into all its relations with the surrounding medium.

Descriptions of new Species of *Forficulidæ* in the Collection of the British Museum (Nat. Hist.), S. Kensington. By W. F. KIRBY, F.L.S., F.E.S.

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(PLATE XX.)

SINCE the publication of my "Revision of the *Forficulidæ*" (Linn. Soc. Journ., Zool. vol. xxiii. pp. 502-531), little of importance has been published on the family, except an article by De Bormans in the 'Biologia Centrali-Americana,' and the descriptions of a few new species by De Bormans, Brunner von Wattenwyl, and others. *Forficulidæ* are insects which are seldom collected, and they generally arrive as single specimens, which are frequently damaged, or, if perfect, are not sufficiently well marked to render it advisable to characterize them from a single specimen, necessarily representing only one sex. Consequently, I have only about a dozen new species to describe in the present paper; but some of them are extremely handsome and remarkable forms acquired from the collection of the late Mr. Pascoe and from other sources.

There is an error in my Table of Genera (pp. 504-505 of the above-quoted paper), which it may be as well to take the present opportunity of conspicuously rectifying. On p. 504, 2nd &